

Claims

- [c1] A method for optimizing the placement of a plurality of cells on a VLSI chip comprising the steps of:
- a) subdividing the plurality of cells into partitions by performing a sequence of cuts;
 - b) iteratively managing the sequence of cuts to perform a look ahead operation;
 - c) returning to the cut from where the look ahead operation was initiated by comparing the original placement with the cut provided by the look ahead operation; and
 - d) altering the priority of the placement to ensure that the quality of the results achieved at the look ahead point is improved.
- [c2] The method of claim 1, wherein in step b) further comprises the steps of
- b1) performing a cost function analysis to quantify the quality of the placement;
 - b2) optimizing the quality of the placement; and
 - b3) generating placement directives to force the placement to move in a direction specified by the optimization
- [c3] The method of claim 2, wherein the selection of look ahead points varies in accordance with the level of opti-

mization required.

- [c4] The method of claim 2, wherein the degree of look ahead is variable and varies in accordance with the needs of a specific optimization.
- [c5] The method of claim 2, wherein multiple optimizations are part of a single placement flow wherein a single optimization has the same or different degrees of look ahead.
- [c6] The method of claim 2 wherein the cost function defines metrics that include the level of congestion of a placement and timing considerations
- [c7] The method of claim 2 wherein the optimization function identifies specific improvements that are required by the placement
- [c8] The method of claim 7 wherein the optimization function for timing comprises logic restructuring, repowering, and buffer insertion.
- [c9] The method of claim 7 wherein the optimization function for congestion includes self-spreading of cells.
- [c10] The method of claim 2 wherein the directives drive the placement process in a direction indicated by specific

optimizations.

[c11] The method of claim 10 wherein the directives driving the placement towards a timing optimization comprise net weighting, capacitance, target generation, cell to cell affinities and cell to area affinities.

[c12] The method of claim 10 wherein the directives driving the placement towards a congestion optimization comprise the generation of reserve areas and cell expansion.

[c13] A method for optimizing the placement of a plurality of cells on a VLSI chip comprising the steps of:

- a) subdividing the plurality of cells into partitions by performing a sequence of cuts;
- b) iteratively managing the sequence of cuts to perform a look ahead operation, wherein the look ahead operation comprises the steps of:
 - b1) performing a global routing,
 - b2) evaluating the global routing congestion, and
 - b3) performing a cell expansion and blockage insertion where a congestion is encountered;
- c) returning to the cut from where the look ahead operation was initiated by comparing the original placement with the cut provided by the look ahead operation; and
- d) altering the priority of the placement to ensure that the quality of the results achieved at the look ahead

point is improved.

- [c14] A method for optimizing the placement of a plurality of cells on a VLSI chip comprising the steps of:
- a) subdividing the plurality of cells into partitions by performing a sequence of cuts;
 - b) iteratively managing the sequence of cuts to perform a look ahead operation, wherein the look ahead operation comprises the steps of:
 - b1) performing a timing analysis of the entire plurality of cells;
 - b2) repowering and inserting buffers in a netlist to improve the timing and for determining which timing problems are related to the placement; and
 - b3) generating net weights for critical nets;
 - c) returning to the cut from where the look ahead operation was initiated by comparing the original placement with the cut provided by the look ahead operation; and
 - d) altering the priority of the placement to ensure that the quality of the results achieved at the look ahead point is improved.
- [c15] A program storage device readable by a machine, tangibly, embodying a program of instructions executable by the machine to perform method steps for performing static timing analysis of a digital system in the presence

of a plurality of global sources of delay variation, said method steps comprising:

- a) subdividing the plurality of cells into partitions by performing a sequence of cuts;
- b) iteratively managing the sequence of cuts to perform a look ahead operation;
- c) returning to the cut from where the look ahead operation was initiated by comparing the original placement with the cut provided by the look ahead operation; and
- d) altering the priority of the placement to ensure that the quality of the results achieved at the look ahead point is improved.